LAKE TAHOE BASIN STUDY

Sub-Report

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Silt, Sand and Dust

from

Winter Maintenance Operations

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Silt, Sand and Dust from Winter Maintenance Operations

A. The Problem

Sand and cinders used along with salt for de-icing the pavement under winter conditions must be removed periodically in the developed areas. This is presently done with highway sweepers which pick up about 90% of the material. The remainder is left to be washed away during rain runoff or whipped off by traffic, causing dust. The sweeping operation is also a source of dust.

There have been many local area complaints about this dust problem. It can properly be classified as both an air and water quality problem.

Complaints have also been received from residents in the Echo Summit area regarding the use of cinders. It is claimed that the cinders do not lend themselves as readily to being carried away by wind and water action and therefore tend to build up along the road, causing an unsightly appearance and inhibiting plant growth.

Resistance to being carried away is considered desirable from the standpoint of reduction of silt and dust. Further evaluation is necessary to determine whether plant growth is in fact affected by this material.

B. The Investigation (still underway)

A 3,500 gallon water truck with a high pressure pump and nozzle mounted on the front was used in an attempt to remove debris without causing dust in the South Lake Tahoe area.

The result was unsatisfactory for use in this area due to the excessive amount of silt-carrying water which resulted. It also threw the muddy water onto adjacent properties (see picture - Plate I).

Two vacuum type street cleaners were demonstrated in the South Lake Tahoe developed area also. One, called the Giant-Vac, was trailer-mounted and had no dust filter or spray system. The other, called the Sani-Vac, was a large truck-mounted unit with a built in water spray system.

The comparison of these two units can be seen in the accompanying pictures (Plate II).

This area had not been swept since last fall, therefore, the accumulation of sand, dirt, and pine needles was much heavier than would have been encountered if a regular sweeping schedule were maintained. The demonstration was necessary to evaluate and compare abilities of these two vacuum units to clean loose and compacted sand and debris from the gutter line in lieu of a standard street sweeper.

The Giant-Vac Model 3000 was equipped with a 4-cylinder, air-cooled 30-horsepower engine, with a 16" intake hose that discharged into a rectangular bin of approximately 2 cubic yard capacity. The bin is not a part of this unit; it was used for demonstration purposes only. The blower(vacuum) housing, which bolts directly to the engine base, encloses a 25" diameter impeller, which has four 1/2" thick steel plates and is connected to the engine crank shaft. The 16" nozzle was moved along the gutter line to pick up undisturbed material at the rate of 100'

in two minutes. Three passes were necessary to remove all material. This unit was not equipped with water spray or discharge filter systems, therefore, was extremely dusty, which is unacceptable.

As equipped, the vacuum capacity is equal to the Sani-Vac unit, but would probably be reduced considerably if a water spray and filter system is installed to eliminate dust. If these features were installed, the manufacturer could, and probably would, utilize his Model 6800 Giant-Vac unit powered by a 4-cylinder, 68-horsepower, water-cooled engine to maintain vacuum capacity.

The Model 3000 unit sells for $2,400.00 and weighs 1,353 pounds. The Model 6800 costs $3,800.00 and weighs 2,338 pounds.

The Wayne Sani-Vac Model 1600 unit is a self-contained, 16-cubic yard capacity powered by an 8-cylinder, 145-horsepower, water-cooled engine equipped with a 39-inch diameter fan in the blower, 12-inch intake hose, 300-gallon water storage tank, water spray system, exhaust filters, and a 30-inch wide litter leaf attachment for the intake nozzle. Both the 12-inch nozzle and the 30-inch wide leaf nozzle were used to determine the effectiveness of each. Since the 30-inch nozzle covers a wider swath it was considered superior. For our operation, it would need to be mounted on a remote controlled holding device to guide it along the gutter for best results. The pickup nozzles are hard to hold in a proper position manually. Under like conditions, this unit also made one pass over 100' in two minutes, with three passes necessary to remove and clean all the material from the gutter line. Due to the water spray and discharge

filter system, there was practically no dust discharged into the air. Purchase price of this unit complete with truck is $39,000.

A very important application for this unit is cleaning drop inlets. By building a settling basin into a drop inlet, we could accumulate a great deal of sand and silt which would otherwise go into the rivers and the Lake.

The frequency of use will play an important role in the effectiveness of any vacuum type cleaner. Many combinations should be tried, using sweepers, blades, brooms, and loaders in conjunction with this type of cleaner during the coming winter season.

Another important factor in the production of dust and silt is the grading of the sand and cinder material used for de-icing.

Durability and grading specifications were adopted two years ago in an effort to reduce the dust problem, but were not used in all areas of the basin.

These specifications are as follows.

Screen Size	Percent Passing
3/8"	100
No. 4	90-100
No. 8	55-85
No. 200	0-3

Durability Index (D_f) - 55 minimum
Moisture content at time of delivery - 5% maximum

C. Test Procedure

Samples of various sources of sand and cinders were tested using a variety of test methods in an attempt to simulate tire and chain action under traffic conditions. The test results are attached. (Attachment A)

The fine grade durability test represents the resistance to breakdown of a washed sample of material passing the No. 4 sieve when subjected to abrasion by mechanical shaking action while submersed in water. The actual numerical value (Durability - fine grade) is derived by measuring the height of sand vs. the height of clay after they have settled 20 minutes in a graduated cylinder.

i.e. - With the top of sand at 6" and the top of clay at 10", the durability would be $\frac{6}{10} \times 100 = D_f = 60$.

The higher the value, the more resistance to breakdown and the more durable the material would be. This is a measure of what might be expected of a material subjected to handling and rehandling as well as weathering while being stockpiled.

The pulverizer was used to simulate tire action on a de-icing sand or cinders on the pavement. A grading analysis was run on the material before and after pulverizing. The pulverizer consists of a steel drum about 11" in diameter and 16" long. Rollers covered with rubber and about 2" in outside diameter, weighing about 7½ pounds each, are used inside the drum. For this test 10 pounds of material was placed in the drum with two rollers and the drum was rotated at 65 RPM for 30 minutes. The before and after grading and sand equivalent are shown in the tests results.

This adaptation of the pulverizer was devised to simulate tire action on the material on the pavement.

D. Evaluation

Even though the three materials used in the Tahoe Basin seem to be running high in the fine grading category, the material did serve the purpose for which it was intended, as an aid to pavement de-icing. The concern for the excess amount of fines is generated mainly from the silt and dust producing potential. This could be a very important factor in determining what measures should be taken to alleviate the dust and silt problem.

It is evident from the test results that several of the sources have outstanding quality from the standpoint of durability; the black cinders from Carson City and Rainbow Mountain and the sand from Auburn. Two of these also showed a very high resistance to pulverization in the finer grading (dust producing) category; the black cinders from Rainbow Mountain and the sand from Truckee.

Notwithstanding the complaints mentioned in Section A, cinders have other qualities which make them desirable for use as a de-icing material. The material is more angular in shape, with sharper edges, more heat absorbent due to color, and lighter in weight.

Even though the quality of de-icing material is improved, we must recognize that there are other sources of dirt which contribute to silt and dust on our highways. Some of these, such as unpaved shoulder areas and unprotected cut slopes, are within our jurisdiction. Some others, such as unpaved side roads and driveways, are not.

A year's trial use of a well-graded non-degradable material in predetermined test areas would indicate how extensive these other factors are.

It is most probable that a washing process will have to be employed in order to remove the excess amount of material passing the No. 200 sieve, at least from some of the sources. This should not be required until further evaluation is complete. It is recommended that future purchases of material be made with the understanding that it will be sampled at the source and tested for compliance prior to acceptance for delivery. This will give us a basis for determining the effect of a given quality of material in a given area.

The use of cinders in the developed area at South Lake Tahoe may prove to be better than sand in that most of the material is picked up after it has served its purpose. No residue would be left to generate complaints such as were received in the Echo Summit area.

On the other hand, sand may be the better choice where the use of cinders is now generating complaints. Only a winter's trial use will provide the answers to these questions.

E. Proposed Action

The following specifications will be adopted for the coming winter season in order to establish a basis for comparison. Material somewhat equal to that which has been used in the recent past will be used as it has been, but certain carefully chosen test areas will be set aside for exclusive use of the best material

available in the area. Other test sections will be used to compare sand versus cinders for accumulation of silt, production of dust and general aesthetic effect and visual impact.

1971-72 Specifications
for De-icing Sand and Cinders

Sieve	% Passing Sand	Cinders
3/8"	100	100
No. 4	90-100	80-100
No. 8	60-90	50-80
No. 200	0-4	0-9
Durability	55	55
Sand Equivalent	75	75

A slightly different specification is recommended for cinders than for sand. A greater amount retained on the #4 sieve is considered safe from the standpoint of damage to windshields because the cinder product is considerably lighter in weight. The greater amount allowable for passing the #200 sieve for cinders is considered justifiable from the standpoint that the cinders are likely to have no vegetative matter or nutrients in the finer material such as might be found in sand.

Various combinations of the previously mentioned street cleaning equipment will also be used and evaluated this next winter.

F. Cost

The last but not the least consideration is cost. As it appears now, the two products are somewhat competetive, but any change in grading requirements may alter the situation. The difference in effect might outweigh the difference in cost. It is also quite probable that lighter application rates could be used if more effective material is found compatible. These factors will be evaluated next year.

Attachments

SUMMARY OF TEST RESULTS ON CINDERS AND SAND

Basin Area	Owner & Source	Material	Dura-bility	Resistance to Pulverization*	Grading of minus 50 SE	50	100	200	5M	1M
A	Teichert Truckee	Sand	58	As Rec'd.	80	21	11	8	3	1
				Pulver.	67	28	15	11	2	1
B	Savage Constr. Carson City	Cinders (Black)	83	As Rec'd.	95	20	14	9	1	0
				Pulver.	85	23	18	12	2	1
C	Harms Bros. Meyers	Sand	70	As Rec'd.	63	30	13	7	2	1
				Pulver.	56	38	20	11	4	3
I-80(Not in Basin)	Sutherland Auburn	Sand	82	As Rec'd.	85	22	4	2	1	1
				Pulver.	90	22	6	2	1	1
Not presently being used for de-icing	Sha-Neva Rainbow Mountain	Cinders (Black)	87	As Rec'd.	--	20	15	10	2	1
				Pulver.	--	21	15	11	2	1
" " "	Sha-Neva Rainbow Mountain	Cinders (Red)	65	As Rec'd.	--	29	14	8	2	1
				Pulver.	--	26	17	10	4	1
" " "	Bing Constr. Co. Minden, Nevada	Sand	78	As Rec'd.	76	12	5	4	3	2
				Pulver.	--	15	8	6	4	3
" " "	Bing Constr. Co. Minden, Nevada	Sand	80	As Rec'd.	79	10	5	3	2	1
				Pulver.	--	14	7	5	3	2
" " "	Bing Constr. Co. Minden, Nevada	Sand	80	As Rec'd.	78	12	5	4	3	2
				Pulver.	--	16	8	6	3	2

*Pulverizing was done using 10 pounds of material and two pulverizer bars. The pulverizer was run for 30 minutes and the material was than analyzed. The object of this procedure was to simulate tire action on the material.

ATTACHMENT A

ED-50-SLT Use of high pressure nozzle on pumper proved unsatisfactory for urban areas. Note mud being splashed onto adjacent property.

ED-89-Emerald Bay An example of the dirty snow in an area where sand is used.

ED-50-Echo An example of the dirty snow in an area where cinders are used.